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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
SMITH, NICHOLAS A	
ART UNIT	PAPER NUMBER
1742	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/18/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/615,794	ANDRICACOS ET AL.	
	Examiner	Art Unit	
	Nicholas A. Smith	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *16-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn. Please see p. 3, lines 5-6 of Applicant's Remarks submitted on 22 December 2006.

Status of Claims

2. Claims 16-26 remain for examination.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 16-20 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. (US Patent 6,881,319) in view of Blachier et al. (US Patent 6,569,307), further in view of Kopp (US Patent 6,083,374) and further in view of Sun et al. (US 2002/0125142).

5. Regarding claim 16, Seita et al. teach a method for controlling the composition of a copper plating bath comprising:

- providing plating bath and obtaining an aliquot, i.e., a bath liquor (column 3, lines 14- 30 and column 4, lines 64-67)
- determining the concentration of an accelerator byproduct, referred to as –X—S$^-$ (column 4, lines 60-64). This is equivalent to the claimed "void formation marker" as defined in applicant's specification.

- maintaining the VFM concentration below a certain threshold level (column 5, lines 56-67).

6. However, in regards claimed features "counting, for each of said time-points, the number of voids in the metal plated on said substrate" and determining said threshold VFM concentration as the largest VFM concentration at which no voids are observed, Seita et al. does not specifically teach counting the number of voids and setting the acceptable range (or threshold value) for the byproduct concentration according to the number of voids.

7. Blachier et al. teach a method for plating objects wherein certain aspects of the plating process are monitored in order to maintain the byproduct concentration below a predetermined value. In one embodiment, the degree of void-free plating is measured, which is equivalent to counting the number of voids (column 7, lines 49-61). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Seita et al. by counting the number of voids as taught by Blachier et al., and using this value to determine the threshold value, because Blachier et al. teach that monitoring this aspect provides an indication of the condition of the plating substances (column 7, lines 62-64).

8. However, Seita et al. in view of Blachier et al. does not teach performing a bleed and feed to maintain the VFM concentration below the threshold value.

9. Kopp teaches a method for maintaining a constant concentration of plating bath components wherein a portion of the plating bath is periodically removed and replenished with fresh solution (see abstract). The volume of solution removed is equal

to the volume added (column 3, lines 46-51). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Seita et al. in view of Blachier et al. by incorporating a bleed and feed step as taught by Kopp, because Kopp teaches that removal of the solution containing decomposition products leads to an extension in the serviceable life of the bath (column 3, lines 25-35).

10. Examiner notes that Seita et al. in view of Blachier et al. and further in view of Kopp does not specifically teach a step of measuring the bath concentration of said at least an accelerator.

11. Sun et al. discloses a method of measuring the bath concentration of said at least an accelerator in an electrochemical plating process (paragraphs [0006] and [0009]). It would have been obvious to one of ordinary skill in the art to modify Seita et al. in view of Blachier et al. and further in view of Kopp's method with a step of measuring accelerator concentration in order to perform optimal and controllable plating (Sun et al., paragraphs [0006]-[0009]). Furthermore, it is noted that such a step of measuring accelerator concentration would be inherently done at a plurality of time-points in order to monitor the process (Sun et al, paragraphs [0006]-[0009]).

12. Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. expressly teaches all elements of claim 16 except the following: There is no express mention of a VFM ratio as claimed and the process is not expressly maintained at a VFM threshold ratio, in that the above combination teaches in terms of VFM concentration and VFM threshold. Examiner notes that steps of determining VFM ratio and VFM threshold ratio are performed inherently in that the measurements necessary

to determine (or to calculate) the VFM ratio and VFM threshold ratio are taught in the above combination. A mathematical calculation (determining) is not a patentable designation and therefore the prior art inherently teaches such determination steps. Furthermore, Seita et al. in view Blachier et al., further in view of Kopp and further in view of Sun et al. teaches maintaining the VFM concentration below a VFM concentration threshold. Given that performing bleed and feed of a plating bath is designed to keep accelerator concentrations constant (Kopp, abstract), maintenance of a VFM concentration below a VFM concentration threshold would be inherently equivalent to maintenance of a VFM ratio below a VFM threshold ratio under conditions wherein the accelerator concentrations are maintained to be substantially constant.

13. Regarding claim 17, Seita et al. teach that determining the concentration comprises separating the VFM from the solution and quantifying it (column 4, lines 60-64). Although these steps are not expressly recited, they are inherent to the process of measuring a concentration by high speed liquid chromatography.

14. Regarding claims 18-20, Seita et al. teach that the VFM is separated by high speed liquid chromatography (column 4, lines 60-64). This technique is synonymous with high performance liquid chromatography (HPLC).

15. Regarding claim 24, HPLC would inherently provide a quantitative output in proportion to the concentration of VFM. Specifically, HPLC provides a chromatogram consisting of a series of peaks corresponding to different analytes. The area under a peak is integrated to obtain the concentration of the analyte.

16. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. as stated above in regards to claim 18, and further in view of Skoog et al. (*Fundamentals of Analytical Chemistry* 7th Ed.; Saunders College Publishing, Forth Worth, **1996**, pp. 701-702 and 708-709).

17. Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. teach the features as previously described. However this reference does not teach that the method of chromatography is ion-pairing, reversed-phase chromatography.

18. Skoog et al. teach that reversed phase liquid chromatography is a subset of high performance liquid chromatography (see Figure 30-2 and pp 708-709). Furthermore, the term "ion pairing" refers to the solvent system used in the HPLC and thus is merely describing the chromatography conditions. It would have been obvious to one of ordinary skill in the art at the time of the invention to select reversed phase chromatography from the broader category of HPLC taught by Seita et al., because Skoog et al. teach that the eluent for this technique are aqueous solutions, which is advantageous to using pure organic solvents (pg 709).

19. Claims 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. as stated above in regards to claim 17, and further in view of Talasek et al. (US2004/0108213).

20. Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. teach the features previously described. However, this reference combination does not teach that the quantifying is performed by spectroscopy or electrochemical deposition.

21. Talasek et al. teach a method for controlling the composition of a plating bath wherein the amount of additive breakdown byproduct is measured by optical or electrochemical techniques (paragraph 29 and paragraph 38). Regarding claim 8, an optical technique would comprise ultraviolet, visible, and infrared spectroscopy. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. by using optical or electrochemical techniques to quantify the VFM concentration as disclosed by Talasek et al., because Talasek teaches that these methods allow direct real-time detection of byproducts (paragraph 49).

22. Claims 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. as stated above in regards to claim 16, and further in view of Kopp.

23. Seita et al. in view of Blachier et al., further in view of Kopp and further in view of Sun et al. teach the features as previous described.

24. Regarding claims 25 and 26, it would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the fractional volume of the bath which is replaced, because Kopp teaches that the quantity of solution replaced should be adapted to the specific plating parameters (column 3, lines 36-45).

Response to Arguments

25. Applicant's arguments with respect to claim 16 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas A. Smith whose telephone number is (571)-272-8760. The examiner can normally be reached on 8:30 AM to 5:00 PM, Monday through Friday.

27. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571)-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

28. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NAS

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